**Project Title: Finger Tracking System for Researching Braille Reading**

**Project Keyword: Fingertracking**

**Project Appropriate for:** ECE

**Summary:** This project will build a robust research instrument using Computer Vision to track the fingers of individuals who read braille. Cognitive scientists generally rely on eye-tracking to research how typically-sighted individuals read printed text, and there are numerous eye trackers available for laboratory and experimental use. However, there are currently no equivalent instruments available for the purpose of researching how tactile readers read braille. Precise and robust tracking (whether eye tracking for print reading or finger-tracking for braille reading), is crucial for understanding the perceptual and cognitive processes that underlie reading in any medium, since speed, latency, and regression all reflect underlying aspects of visual or tactile processing, and the cognitive processing related to specific aspects of the text being read. For finger tracking, we need to know factors including: which finger(s) are in contact with which character(s) at a given point in time; the rate of transition from one point in the text to another; the latency of a finger on a particular character or point in the text; the origin and destination of regressions (the points at which a finger stops, reverses direction, and rereads a span of text).

**Specifications:**

* Ability to independently track up to four fingers on each hand (thumbs are not used in braille reading).
* A minimum sampling rate of 60Hz (100Hz would be ideal).
* Output should be written to a tab-delimited text file, one record per sample and include a timestamp, followed by the XY pixel coordinates of each of the (up to) 8 fingers.
* Must also include the captured video and audio data, time-aligned with the tracking data.
* Ideally, a robust finger tracker would also include pressure information for each finger (although this is a lesser priority for current research purposes).
* Able to be replicated by other labs (i.e. open source and with parts that ideally cost < $10k).
* The system should be easily portable to pack up and take to research sites.
* Able to be used in various lighting conditions.
* Avoid encumbering fingers and arms with wires or LEDs.
* Ability to handle a wide variation in reading styles and finger angle (e.g. whether a reader reads using the balls of the fingers and keeps the fingers flat on the page, or whether a reader reads using the fingertips and steeply angles the fingers).

**Overall Goals:**

During the first semester, students will determine the best technologies and methods for designing the instrument. Students will also work closely with Englebretson to observe videos of braille reading and learn about previous unsuccessful approaches to finger tracking.

During the second semester, students will build the instrument, and will pilot it with braille readers.

**Project Mentors:**

Gary Woods: Gary.woods@rice.edu

Robert Englebretson: reng@rice.edu